University of California, Berkeley
Physics H7A Fall 1998 (*Strovink*)

PROBLEM SET 8

1. K&K problem 8.5 "Many applications...".

2. K&K problem 8.11 "A high speed hydrofoil...".

3. K&K problem 9.3 "A particle moves...".

4. K&K problem 9.4 "For what values of n...".

5. K&K problem 9.6 "A particle of mass m...".

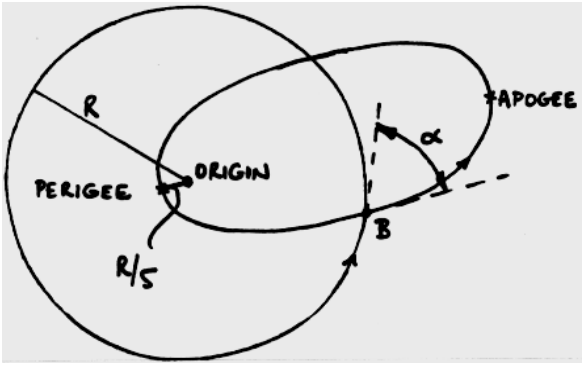
6. K&K problem 9.12 "A space vehicle is in circular orbit...".

7. A satellite of mass m is travelling at speed V in a circular orbit of radius R under the gravitational force of a fixed mass at the origin.

a. Taking the potential energy to be zero at infinite radius, show that the total mechanical energy of the satellite is $-mV^2/2$.

b. At a certain point B in the orbit (see figure), the direction of motion of the satellite is suddenly changed without *any* change in the magnitude of the velocity. As a result, the satellite goes into an elliptical orbit. Its closest approach to the origin is now $R/5$. What is the speed of the satellite at this distance, expressed as a multiple of V?

c. Through what angle α (see figure) was the velocity of the satellite turned at point B?



8. The commander of a spaceship that has shut down its engines and is coasting near a strange-appearing gas cloud notes that the ship is following a path that will take it directly *into* the cloud (see the figure). She also deduces from the ship's motion that its angular momentum with respect to the cloud is not changing. What attractive (central) force could account for such an orbit?